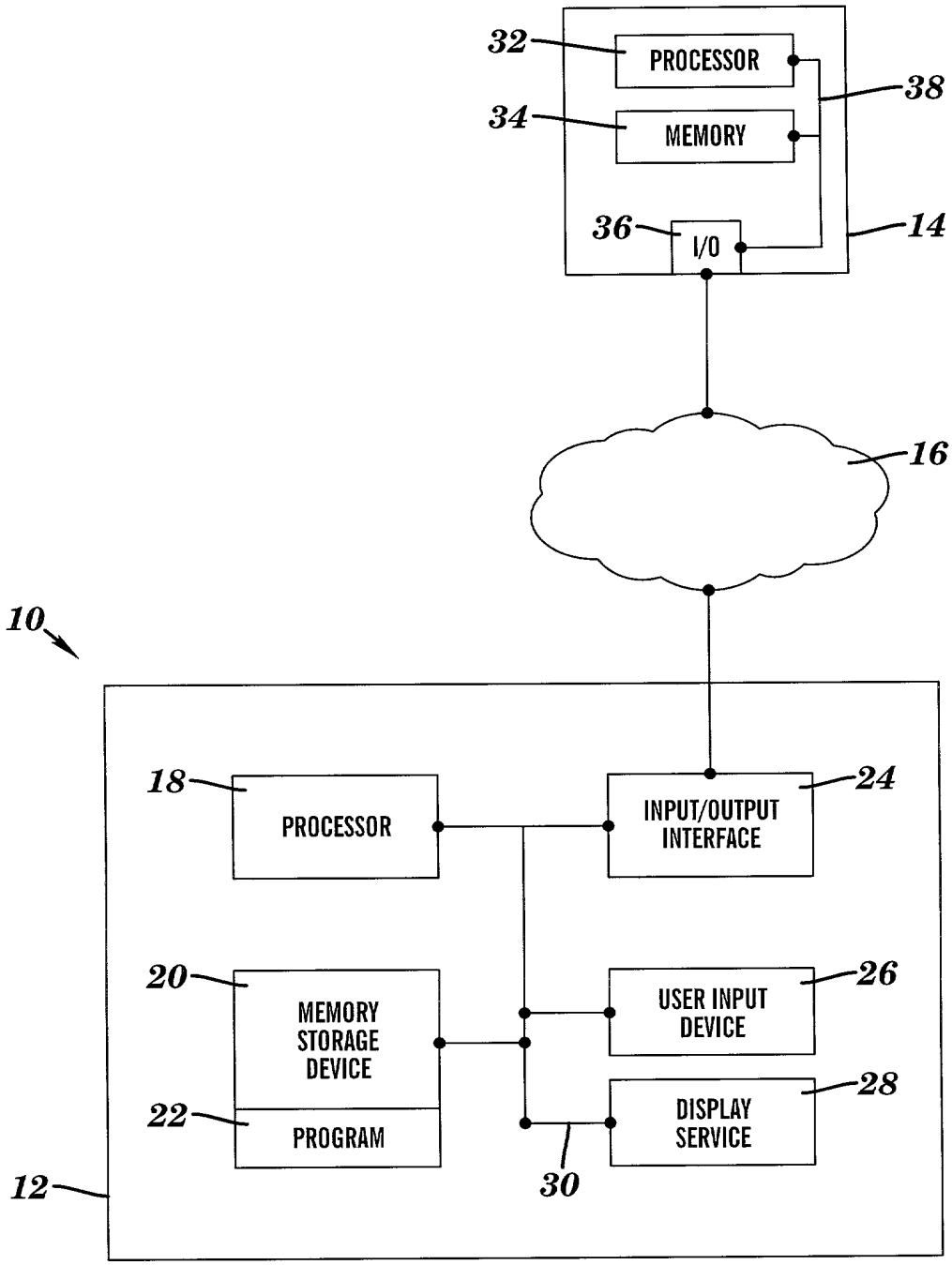
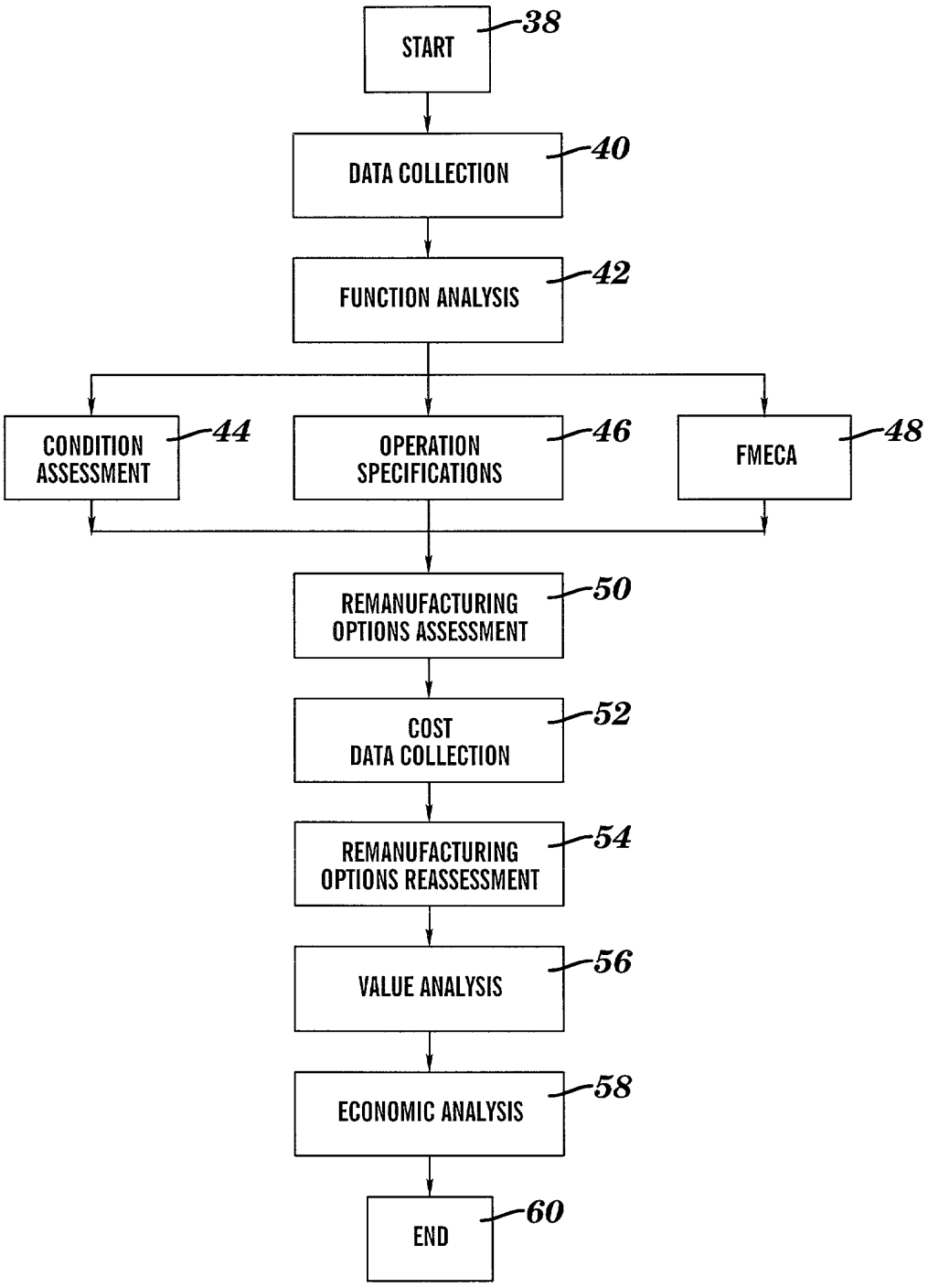

32
PROCESSOR
38
34
MEMORY
36
I/O
14
16
10
18
PROCESSOR
24
INPUT/OUTPUT INTERFACE
20
MEMORY STORAGE DEVICE
26
USER INPUT DEVICE
22
PROGRAM
28
DISPLAY SERVICE
30
12

FIG. 1


START
38
DATA COLLECTION
40
FUNCTION ANALYSIS
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CONDITION ASSESSMENT
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VALUE ANALYSIS
56
ECONOMIC ANALYSIS
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END
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FIG. 2

DATA AVAILABILITY MATRIX

System Hierarchy	Failure log	Manuals	System Map/Drawings	Function definition	OEM specs	Customer specs	Technology upgrade	Condition Assessment	New Cost ($)	Data Missing (Count)	Percent of data
MECHANICAL										1017	52%
Propulsion										186	38%
Drive MTU (port)											
Mounting	×	×	×	●	×	×	×	●	A		
Remote control from the bridge			●	●	×			●	A		
Enclosed operator space controls			●	●	×			●	A		
Local controls			●	●	×			●	A		
Exhaust		×	×	●	×			●	A		
Ignition			×	●					A		
Air intake		×	×	●	×			●	A		
Reduction gearing			×	●	●			●	A		
Water seal		×	●	●				●	A		
Drive shaft		×	●	●				●	A		
Turbocharger				●				●	A		
Salt water cooling		×		●				●	A		
Fuel oil system		×		●	●			●	A		
Engine coolant pre-heater		●	●	●	●			●	A		
Drive MTU internal air compressor				●				●	A		
Hydraulics				●				●	A		
Engine block components		×		●				●	A		
Drive MTU (starboard)											
Mounting	×	×	×	●	×	×	×	●	A		
Remote control from the bridge			●	●	×			●	A		
Enclosed operator space controls			●	●	×			●	A		
Local controls			●	●	×			●	A		
Exhaust		×	×	●	×			●	A		
Ignition			×	●					A		
Air intake		×	×	●	×			●	A		
Reduction gearing			×	●	●			●	A		
Water seal		×	●	●				●	A		
Drive shaft		×	●	●				●	A		
Turbocharger				●				●	A		
Salt water cooling		×		●				●	A		
Fuel oil system		×		●	●			●	A		
Engine coolant pre-heater		●	●	●	●			●	A		
Drive MTU internal air compressor				●				●	A		
Hydraulics				●				●	A		
Engine block components		×		●				●	A		
KaMeWa jet (port)											
Hydraulic powerpack			●	●				●	A		
Hydraulic lines		×	●	●				●	A		
Electric heater		×	×	●				●	A		
Jet nozzle		●	●	●				●	A		
Jet pump		●	●	●				●	A		
KaMeWa jet (starboard)											
Hydraulic powerpack			●	●				●	A		
Hydraulic lines		×	●	●				●	A		

FIG. 3

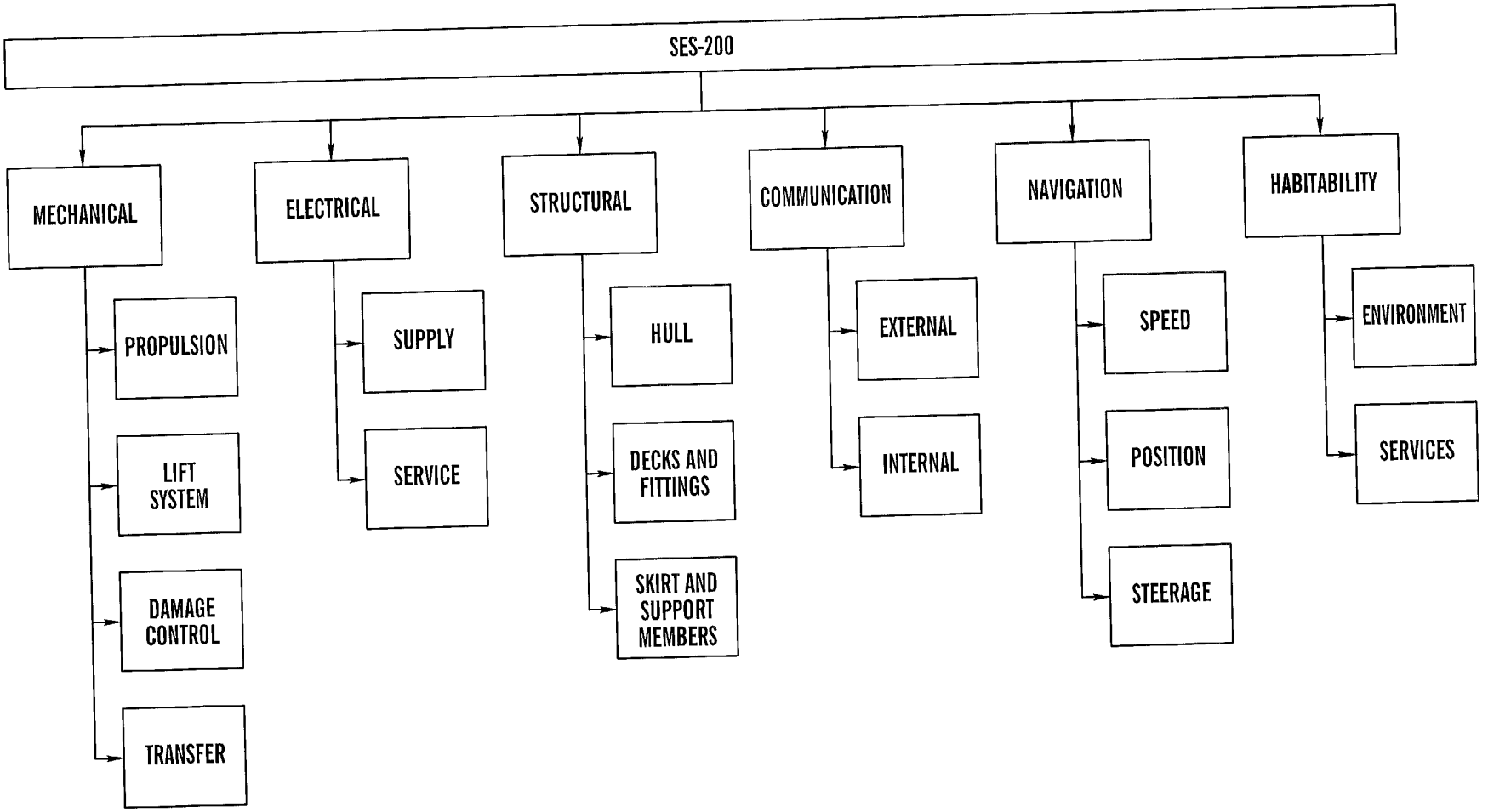


FIG. 4

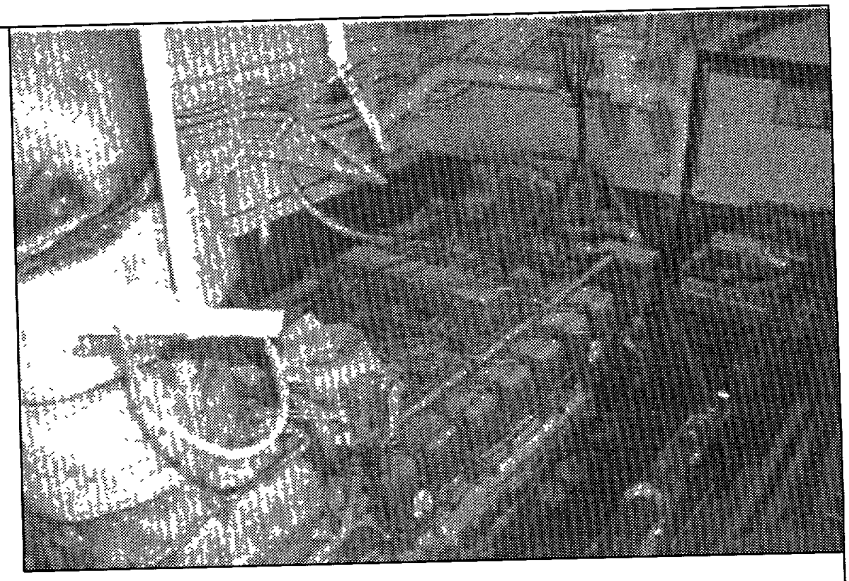
FUNCTION MATRIX

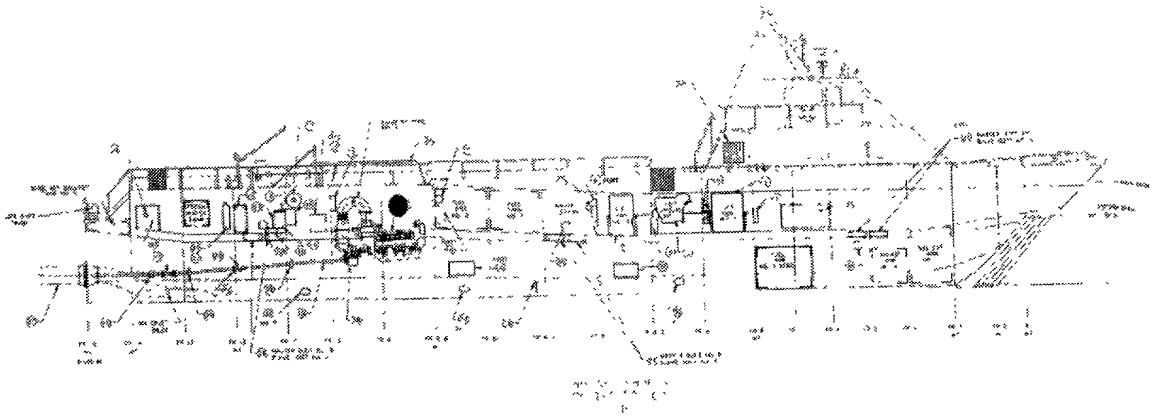
System	Subsystem	Element	Primary Function	Secondary function
MECHANICAL				
Propulsion				
	Drive MTU (port)		Deliver torque to port KaMeWa waterjet pump	
		Mounting	Secure engine to ship framing to prevent movement and vibration	
		Remote control from the bridge	Provide means to control engine from bridge for navigation purposes	
		Enclosed operator space controls	Provide for centralized monitoring and control of engines	
		Local controls	Provide local control of engine functions	
		Exhaust	Expel combustion gases to exterior of ship	
		Ignition	Provide means for engine start-up	
		Air intake	Transfer air to engine for combustion	
		Reduction gearing	Reduce RPMs to KMW jets to prevent cavitation	
		Water seal	Provides seal between drive shaft and bulkhead	
		Drive shaft	Transfer power from engine to KaMeWa waterjet pump (port)	
		Turbocharger	Boost engine power	
		Salt water cooling	Provide cooling to engine, exhaust and reduction gearing	Interface with salt water cooling transfer system
		Fuel oil system	Provide fuel oil to engine	Interface with fuel oil transfer system
		Engine coolant pre-heater	Heat engine coolant during extreme weather to prevent freezing	
		Drive MTU internal air compressor	Provide compressed air for engine functions	Serve as auxiliary source to main L/P air system
		Hydraulics	Provide hydraulic pressure boost for KaMeWa hydraulic pack	Serve as auxiliary source to main hydraulic system
		Engine block components	Convert chemical energy (fuel oil) to mechanical energy	
	Drive MTU (starboard)		Deliver torque to starboard KaMeWa waterjet pump	
		Mounting	Secure engine to ship framing to prevent movement and vibration	
		Remote control from the bridge	Provide means to control engine from bridge for navigation purposes	
		Enclosed operator space controls	Provide for centralized monitoring and control of engines	
		Local controls	Provide local control of engine functions	
		Exhaust	Expel combustion gases to exterior of ship	
		Ignition	Provide means for engine start-up	
		Air intake	Transfer air to engine for combustion	
		Reduction gearing	Reduce RPMs to KMW jets to prevent cavitation	
		Water seal	Provides seal between drive shaft and bulkhead	
		Drive shaft	Transfer power from engine to KaMeWa waterjet pump (starboard)	
		Turbocharger	Boost engine power	
		Salt water cooling	Provide cooling to engine, exhaust and reduction gearing	Interface with salt water cooling transfer system
		Fuel oil system	Provide fuel oil to engine	Interface with fuel oil transfer system
		Engine coolant pre-heater	Heat engine coolant during extreme weather to prevent freezing	
		Drive MTU internal air compressor	Provide compressed air for engine functions	Serve as auxiliary source to main L/P air system
		Hydraulics	Provide hydraulic pressure for engine functions	Serve as auxiliary source to main hydraulic system
		Engine block components	Convert chemical energy (fuel oil) to mechanical energy	
	KaMeWa jet (port)		Convert torque supplied by port drive engine to propulsary force	
		Hydraulic powerpack	Provide hydraulic pressure for waterjet manipulation	Serve as auxiliary source to main hydraulic system
		Hydraulic lines	Transfer hydraulic pressure from powerpack to waterjet	
		Electric heater	Maintain ambient temperature around jets	
		Jet nozzle	Provide means of directing waterflow for steering/reversing	
		Jet pump	Output seawater under pressure to provide propulsary forces	
	KaMeWa jet (starboard)		Convert torque supplied by stbd drive engine to propulsary force	
		Hydraulic powerpack	Provide hydraulic pressure for waterjet manipulation	Serve as auxiliary source to main hydraulic system
		Hydraulic lines	Transfer hydraulic pressure from powerpack to waterjet	
		Electric heater	Maintain ambient temperature around jets	
		Jet nozzle	Provide means of directing waterflow for steering/reversing	
		Jet pump	Output seawater under pressure to provide propulsary forces	

FIG. 5

CONDITION ASSESSMENT DATA SHEET

ESWBS
23310
Function Group
MECHANICAL
System
Propulsion
Subsystem
Drive MTU
Item description
Drive MTU port





Frame location:		Ship location:	
8-6 to 8-10		(11) Port	
Manufacturer:	**Model #:**	**Part #:**	**Serial #:**
Detroit Diesel	MTU 16V-396 TB94		559-0477

Condition:

Mounting, Remote control from the bridge, Enclosed operator space controls , Local controls, Exhaust, Ignition, Air intake, Reduction gearing, Water seal, Drive shaft, Turbocharger, Salt water cooling, Fuel oil system, Engine coolant pre-heater, Aux drive MTU air compressor, Hydraulics, Engine block components, *Operating hours meter = 1930.68 hrs *Turbo rusted *Slight corrosion or other surface damage *Air intakes missing *Water buildup in drive shaft compartment *Coolant manifold severely cracked * Large coupling on drive shaft (FR 13) corroded *Wt. = 6685 kg *2560 kW *2150 RPM *Sea water cooling fitting to reduction gear cracked *See detailed report from Florida Detroit Diesel-MTU for more information

FIG. 6

CONDITION ASSESSMENT MATRIX

System Hierarchy	Physical Condition												Overall Condition		
	Seized/ frozen	Light Corrosion	Severe Corrosion	Excessive Wear	Oil Leakage	Fuel Leakage	Water Seepage	Parts Missing	Dis-connected	Fractured/ Cracked	Ruptured	Poor	Fair	Good
MECHANICAL														
Propulsion													●	
Drive MTU (port)														●
Mounting														●
Remote control from the bridge													●	
Enclosed operator space controls														●
Local controls														●
Exhaust										●				
Ignition								●	●				●	
Air intake							●					●		
Reduction gearing		●											●	
Water seal		●											●	
Drive shaft		●												●
Turbocharger		●											●	
Salt water cooling													●	
Fuel oil system								●					●	
Engine coolant pre-heater			●									●		
Drive MTU internal air compressor													●	
Hydraulics													●	
Engine block components												●		
Drive MTU (starboard)	●											●		
Mounting														●
Remote control from the bridge														●
Enclosed operator space controls													●	
Local controls														●
Exhaust										●				●
Ignition										●		●		
Air intake							●					●		
Reduction gearing		●											●	
Water seal		●											●	
Drive shaft		●												●

FIG. 7

OPERATION SPECIFICATION MATRIX

System	Subsystem	Element	Operational Specification
MECHANICAL			
Propulsion			
	Drive MTU (port)		MTU 16V396TB94, Liquid cooled, Four-stroke diesel engine, Anti-clockwise direction of rotation, High Performance Rating Class 1DS- Fast Vessels, Certification w/classifiable power (0.909 x rated power) from all leading classification societies, Fuel Power Stop kW (mhp): 2580 (3482), Engine output: 3200 bhp each, Speed RPM: 2150, Gearbox Model: BW 755 Free-standing, Transmission Ratio: 2.33 : 1, Bore/Stroke mm (in.): 165/185 (6 5/7.3), Total Displacement L (in³): 63.4 (3866), Intake air temp. 25°C / Sea water temp. 25°C, 3.0% power reduction @ 45°C (air) / 32°C (water); 6685 kg weight
		Mounting	Flanges and conical rubber elements
		Remote control from the bridge	
		Enclosed operator space controls	Sheet-steel housing w/resilient mounts
		Local controls	Speed, Temperatures (coolant, raw water, charge air, exhaust before turbine), Pressure (block, non-return valves, coolant & raw water lines), Fluid levels
		Exhaust	Exhaust gas turbo-charging
		Ignition	Electric starter
		Air intake	Combustion air system- intake filter strainer w/attaching hardware
		Reduction gearing	Valve gear and gear train, Behr BW755, Serial #219 (STBBD) #220 (PORT), Ratio 2.33 : 1

FIG. 8

FAILURE MODES, EFFECTS, AND CRITICALITY ANALYSIS (FMECA)

System	Subsystem	Function	Failure Modes	Cause
Propulsion				
	Drive MTU	Deliver torque to KaMeWa waterjet pump		
		Secure engine to ship framing to prevent movement and vibration	Mounting fails	Wear
				Corrosion
				Manufacturer's defect
		Provide means to control engine from bridge for navigation purposes	Remote control from the bridge fails	Power Failure
				Circuit Interruption
		Provide for centralized monitoring and control of engines	Enclosed operator space controls fail	Power Failure
				Circuit Interruption
		Provide local control of engine functions	Local controls fail	Power Failure
				Circuit Interruption
		Expel combustion gases to exterior of ship	Exhaust fails	Obstruction
				Faulty Seal
				Damaged Piping
		Provide means for engine start-up	Ignition fails	Air System Failure
				Power Failure
				Circuit Interruption
		Transfer air to engine for combustion	Air intake fails	Obstruction
		Reduce RPMs to KMW jets to prevent cavitation	Reduction gear fails	Wear
				Corrosion
				Insufficient Lubrication
				Manufacturer's defect
		Transfer power from engine to KaMeWa waterjet pump (port)	Drive shaft fails	Wear
				Corrosion
				Load
				Manufacturer's defect
		Provides seal between drive shaft and bulkhead	Water Seal leaks	Wear
				Manufacturer's defect
		Boost engine power	Turbocharger fails	Wear
				Corrosion
				Manufacturer's defect
		Provide cooling to engine, exhaust and reduction gearing	Salt water cooling fails	Wear
				Corrosion
				Manufacturer's defect
		Heat engine coolant during extreme weather to prevent freezing	Kim HotStart Engine Coolant Heater fails	Power Failure
				Electrical grounding

FIG. 9A

FAILURE MODES, EFFECTS, AND CRITICALITY ANALYSIS (FMECA)

Local Effect	Secondary Effect	Ultimate Effect	Detection	Sev	Freq	RPN
Excessive engine vibration/movement	Engine failure/drive train damage	Compromised propulsion to ship	Audible	7	3	21
Excessive engine vibration/movement	Engine failure/drive train damage	Compromised propulsion to ship	Audible	7	3	21
Excessive engine vibration/movement	Engine failure/drive train damage	Compromised propulsion to ship	Audible	7	2	14
Loss of engine control from bridge		Inability to remotely control engines	Operational Failure	4	3	12
Loss of engine control from bridge		Inability to remotely control engines	Operational Failure	4	5	20
System fails to respond to controls from ECR	Loss of remote control of engine (from bridge)	Compromised propulsion to ship	Operational Failure	6	3	18
System fails to respond to controls from ECR	Loss of remote control of engine (from bridge)	Compromised propulsion to ship	Operational Failure	6	3	18
Total loss of engine control	Runaway engine	Catastrophic damage to engine/potential loss of life	Audible	9	1	9
Total loss of engine control	Runaway engine	Catastrophic damage to engine/potential loss of life	Audible	9	1	9
Excessive backpressure	Stall engine	Compromised propulsion to ship	Gaging	6	1	6
Exhaust blow-by	Air quality in ship compromised	Health hazard	Gaging/Visual	9	4	36
Exhaust blow-by	Air quality in ship compromised	Health hazard	Gaging/Visual	9	4	36
Engine will not start		Compromised propulsion to ship	Operational Failure	7	4	28
Engine will not start		Compromised propulsion to ship	Operational Failure	7	4	28
Engine will not start		Compromised propulsion to ship	Operational Failure	7	4	28
Reduced airflow to engine	Improper combustion	Compromised propulsion to ship	Gaging	4	2	8
Gearbox/drive shaft damage	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	4	24
Gearbox/drive shaft damage	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	4	24
Gearbox/drive shaft damage	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	5	30
Gearbox/drive shaft damage	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	2	12
Bent/broken drive shaft	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	4	24
Bent/broken drive shaft	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	4	24
Bent/broken drive shaft	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	5	30
Bent/broken drive shaft	No power transmission to KaMeWa	Compromised propulsion to ship	Visual	6	2	12
Seawater leakage	Ship's trim affected	Below deck water/ flooding	Visual	7	4	28
Seawater leakage	Ship's trim affected	Below deck water/flooding	Visual	7	2	14
No boost	Decreased engine output	Reduction in engine efficiency	Gaging	3	4	12
No boost	Decreased engine output	Reduction in engine efficiency	Gaging	3	5	15
No boost	Decreased engine output	Reduction in engine efficiency	Gaging	3	2	6
Engine/Gearbox/Exhaust Overheats	Engine failure	Compromised propulsion to ship	Gaging	6	2	12
Engine/Gearbox/Exhaust Overheats	Engine failure	Compromised propulsion to ship	Gaging	6	3	18
Engine/Gearbox/Exhaust Overheats	Engine failure	Compromised propulsion to ship	Gaging	6	2	12
Inability to preheat coolant at start-up	Potential thermal stressing	Engine failure/thermal cracking of engine block	Gaging	7	3	21
Inability to preheat coolant at start-up	Potential thermal stressing	Engine failure/thermal cracking of engine block	Gaging	7	3	21

FIG. 9B

REMANUFACTURING OPTONS CRITERIA

Condition				Criticality			Operation Specifications			Remanufacturing Options				
Good	Fair	Poor	+	Critical	Non-Critical	+	Meets	Doesn't Meet	=	Modify	Restore	Reuse	Replace	Remove
√				√			√				√	√		
√				√				√		√	√	√		√
√					√		√					√		
√					√			√		√		√		√
	√			√			√				√	√	√	
	√			√				√		√	√		√	√
	√				√		√				√	√		
	√				√			√		√	√	√		√
		√		√			√						√	
		√		√				√					√	√
		√			√		√						√	
		√			√			√					√	√

FIG. 10

REMANUFACTURING OPTIONS MATRIX

Legend:

- Identifies option as a "best" possible choice in the remanufacturing process
- Identifies option as a possible choice in the remanufacturing process
- Identifies option as not feasible in the remanufacturing process

System	Sub-system	Element	Modify	Restore	Reuse	Replace	Remove
Propulsion							
	Drive MTU (port)						
		Mounting					
		Remote control from the bridge					
		Enclosed operator space controls					
		Local controls					
		Exhaust					
		Ignition					
		Air intake					
		Reduction gearing					
		Water seal					
		Drive shaft					
		Turbocharger					
		Salt water cooling					
		Fuel oil system					
		Engine coolant pre-heater					
		Drive MTU internal air compressor					
		Hydraulics					
		Engine block components					
	Drive MTU (starboard)						
		Mounting					
		Remote control from the bridge					
		Enclosed operator space controls					
		Local controls					
		Exhaust					
		Ignition					

FIG. 11

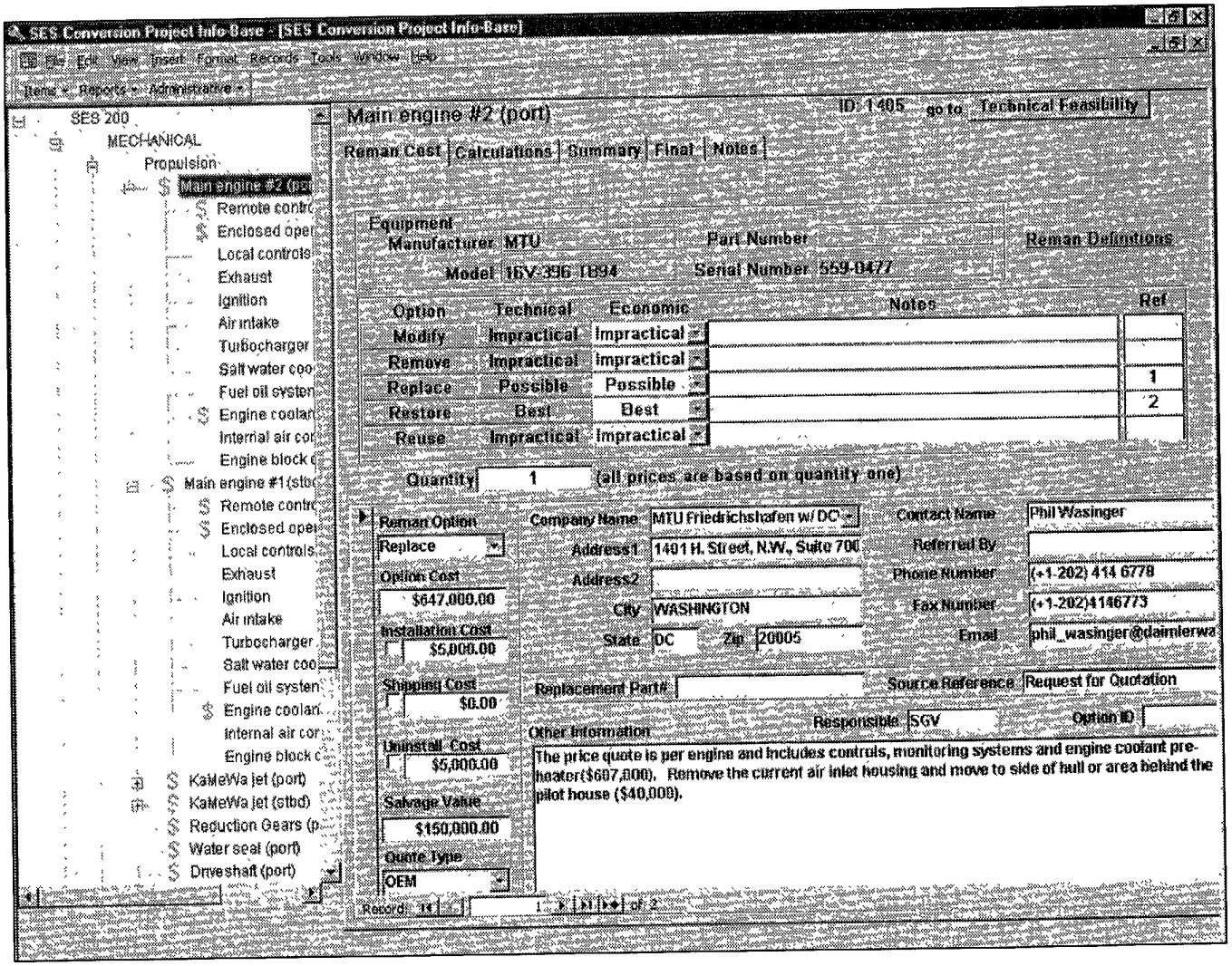

SES Conversion Project Info-Base - [SES Conversion Project Info-Base]
File Edit View Insert Format Records Tools Window Help
Items Reports Administrative
SES 200
MECHANICAL
Propulsion
Main engine #2 (port)
Remote contro
Enclosed oper
Local controls
Exhaust
Ignition
Air intake
Turbocharger
Salt water coo
Fuel oil systen
Engine coolan
Internal air cor
Engine block c
Main engine #1 (sto
Remote contr
Enclosed oper
Local controls
Exhaust
Ignition
Air intake
Turbocharger
Salt water coo
Fuel oil systen
Engine coolan
Internal air cor
Engine block c
KaMeWa jet (port)
KaMeWa jet (stbd)
Reduction Gears (p
Water seal (port)
Driveshaft (port)
Main engine #2 (port)
ID: 1405 go to Technical Feasibility
Reman Cost Calculations Summary Final Notes
Equipment
Manufacturer MTU
Part Number
Reman Definitions
Model 16V 396 TB94
Serial Number 559-0477
Option Technical Economic Notes Ref
Modify Impractical Impractical
Remove Impractical Impractical
Replace Possible Possible 1
Restore Best Best 2
Reuse Impractical Impractical
Quantity 1 (all prices are based on quantity one)
Reman Option
Replace
Option Cost
$647,000.00
Installation Cost
$5,000.00
Shipping Cost
$0.00
Uninstall Cost
$5,000.00
Salvage Value
$150,000.00
Quote Type
OEM
Company Name MTU Friedrichshafen w/ DC
Address1 1401 H. Street, N.W., Suite 700
Address2
City WASHINGTON
State DC Zip 20005
Replacement Part#
Contact Name Phil Wasinger
Referred By
Phone Number (+1-202) 414 6778
Fax Number (+1-202)4146773
Email phil_wasinger@daimlerwa
Source Reference Request for Quotation
Responsible SGV
Option ID
Other Information
The price quote is per engine and includes controls, monitoring systems and engine coolant pre-heater($607,000). Remove the current air inlet housing and move to side of hull or area behind the pilot house ($40,000).
Record 1 of 2

FIG. 12

- x = DATA NOT REQUIRED
- ● = DATA COLLECTED
- (dark shading) = NEED MORE INFORMATION TO PROCEED
- (shading) = ABLE TO LOOK FOR REMAN COSTS
- (shading) = IN THE PROCESS OF GETTING COST INFORMATION
- (shading) = NEED THE REMOVAL COST
- (shading) = DONE

COST AVAILABILITY MATRIX

System Hierarchy	New- Replace	Clean- Reuse	Rework- Restore	Revise- Modify	Remove	Status	Main Contact	Data Missing (Count)	Percent of data
High Value								25	52%
Drive MTU Engines (2)	●	x	●	x	x	Done	SGV		
Reduction gearing (2)	●	●	●	x	x	Done	SGV		
Main Engine Enclosed Operator Space Controls			x	x	x	Need Manufacturer Contact Info			
Lift Engine Enclosed Operator Space Controls	x	x	x	x		Need Removal Cost			
KaMeWa Waterjets (2)	●	x		x	x	Getting other costs	SGV		
MTU Lift Engines (2)	●	x	x	x	●	Done	SGV		
Firemain Pumps (2)	●	x	x	x	x	Done	CJP		
Halon System	●	●	x	x	●	Done	CJP		
Tanks (Fuel Oil -4, Ballast -6, Lube -1)	x			x	x	Waiting on James Brown	SGV		
KaMeWa Hydraulic Powerpacks (2)	●	x		x		Getting other costs	SGV		
Drive MTU Hydraulic Power Take-off Units (2)	●	●		x		Need Contact for other Reman options	SGV		
L/P Air Compressors port	●	x	●	x	x	Done	AJM		
L/P Air Compressors starboard	●	x	●	x	x	Done	AJM		
Seachests (6)			x	x	x	Waiting on Frank	SGV		
Ship Service Diesel Generators (2)	●	x	●	x	x	Done	SGV		
Transformer	●			x	x	Need Contact for other Reman options	AJM		
Electrical Wiring		●	x	x	x	Waiting on Frank	SGV		
Switchboard Generator Control Panel	x			x	x	Waiting on Frank	SGV		
Breaker Boxes (6)	●	x		x	x	Need info on no. of slots in breaker boxes	CJP		
Hull (Shell Plating, Stringers, Frames, Outlets) - drydock,clean,paint,etc.	x	x	x		x	Waiting on Frank	SGV		
Weather Deck	x	x	x		x	Waiting on Frank	SGV		
Water Tight Doors (WTD's)		x		x	x	Waiting for Fax	SGV		
GYRO	●		●	x	x	Need Contact for other Reman options	AJM		
Repeaters			x	x	x	Need Contact for other Reman options	AJM		
Heads (latrines -4, sinks, piping, etc.)	x	x	x	●	x	Done	SGV		

FIG. 13

Option	Recovery	Economic	Notes	Ref
Modify	Impractical	Impractical		
Remove	Impractical	Impractical		
Replace	Possible	Possible		1
Restore	Best	Best		2
Reuse	Impractical	Impractical		

FIG. 14A

Option	Recovery	Economic	Notes	Ref
Modify	Impractical	Impractical		
Remove	Impractical	Impractical		
Replace	Best	Best	Dependent on recovery option for main drive MTU	226
Restore	Possible	Possible		270
Reuse	Impractical	Impractical		

FIG. 14B

Scenario #1:	REPLACE *MTU* engine		REPLACE *Kim Hotstart* w/ internal unit
Scenario #2:	RESTORE *MTU* engine	REQUIRES	REPLACE *Kim Hotstart* w/ new unit
Scenario #3:	RESTORE *MTU* engine		RESTORE *Kim Hotstart*

FIG. 14C

PAIRED COMPARISON MATRIX
DETERMINING WEIGHTS FOR VALUE ANALYSIS

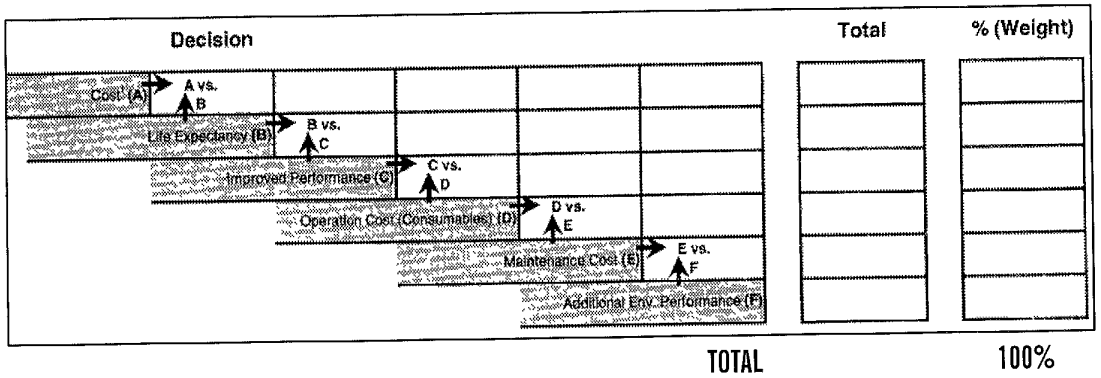


FIG. 15

PAIRED COMPARISON MATRIX
DETERMINING WEIGHTS FOR VALUE ANALYSIS

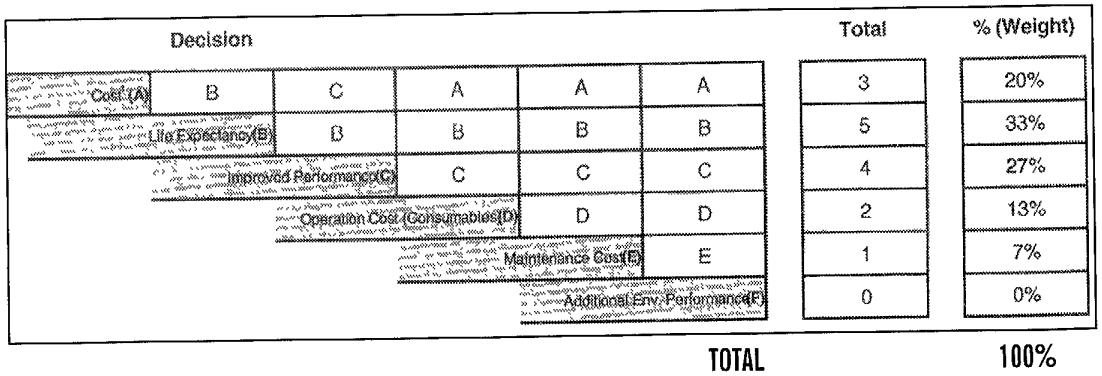


FIG. 16

Replace Reman Option	% (Weight)	Ratings
Cost (A)	20%	4
Life Expectancy (B)	33%	4
Improved Performance (C)	27%	4
Operation Cost (Consumables) (D)	13%	3
Maintenance Cost (E)	7%	4
Additional Env. Performance (F)	0%	3

FIG. 17A

Restore Reman Option	% (Weight)	Ratings
Cost (A)	20%	3
Life Expectancy (B)	33%	4
Improved Performance (C)	27%	3
Operation Cost (Consumables) (D)	13%	3
Maintenance Cost (E)	7%	4
Additional Env. Performance (F)	0%	3

FIG. 17B

Replace Reman Option	% (Weight)	Ratings	Score
Cost (A)	20%	4	**0.80**
Life Expectancy (B)	33%	4	**1.33**
Improved Performance (C)	27%	4	**1.07**
Operation Cost (Consumables) (D)	13%	3	**0.40**
Maintenance Cost (E)	7%	4	**0.27**
Additional Env. Performance (F)	0%	3	**0.00**
		TOTAL	3.87

FIG. 18A

Restore Reman Option	% (Weight)	Ratings	Score
Cost (A)	20%	3	**0.60**
Life Expectancy (B)	33%	4	**1.33**
Improved Performance (C)	27%	3	**0.80**
Operation Cost (Consumables) (D)	13%	3	**0.40**
Maintenance Cost (E)	7%	4	**0.27**
Additional Env. Performance (F)	0%	3	**0.00**
		TOTAL	3.87

FIG. 18B

Paired Comparison Matrix

Determining Weights for Value Analysis - Main MTU Engine/Kim Hotstart Scenario

Decision						Total	% (Weight)
Cost (A)	B	C	A	A	A	3	20%
	Life Expectancy(B)	B	B	B	B	5	33%
		Improved Performance(C)	C	C	C	4	27%
			Operation Cost (Consumables)(D)	D	D	2	13%
				Maintenance Cost(E)	E	1	7%
					Additional Env. Performance(F)	0	0%
					Total	15	100%

FIG. 19

Scenario #1	% (Weight)	Ratings	Score
Cost (A)	20%	3	0.60
Life Expectancy (B)	33%	5	1.67
Improved Performance (C)	27%	4	1.07
Operation Cost (Consumables) (D)	13%	4	0.53
Maintenance Cost (E)	7%	3	0.20
Additional Env. Performance (F)	0%	4	0.00
		Total	4.07

FIG. 20A

Scenario #2	% (Weight)	Ratings	Score
Cost (A)	20%	4	0.80
Life Expectancy (B)	33%	4	1.33
Improved Performance (C)	27%	3	0.80
Operation Cost (Consumables) (D)	13%	3	0.40
Maintenance Cost (E)	7%	3	0.20
Additional Env. Performance (F)	0%	3	0.00
		Total	3.53

FIG. 20B

Scenario #3	% (Weight)	Ratings	Score
Cost (A)	20%	4	0.80
Life Expectancy (B)	33%	4	1.33
Improved Performance (C)	27%	3	0.80
Operation Cost (Consumables) (D)	13%	3	0.40
Maintenance Cost (E)	7%	3	0.20
Additional Env. Performance (F)	0%	3	0.00
		Total	3.53

FIG. 20C

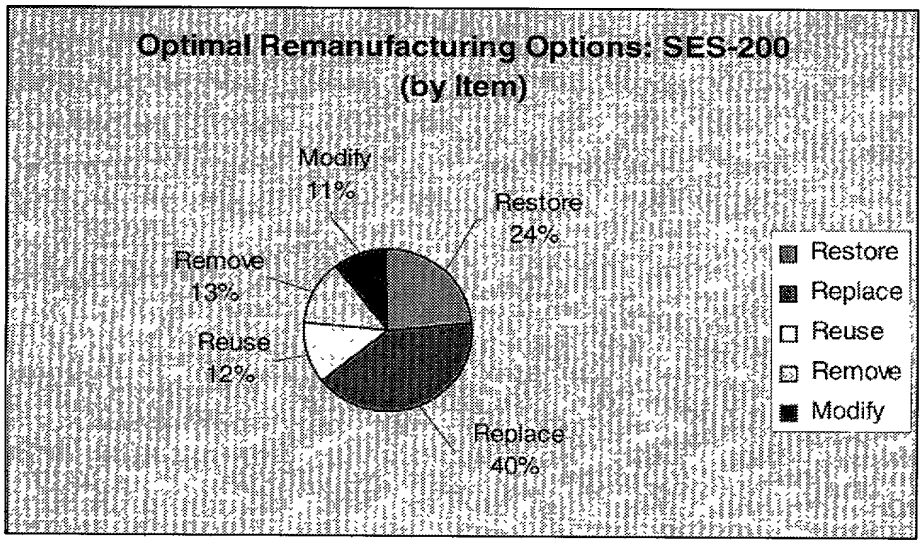

Optimal Remanufacturing Options: SES-200
(by Item)
Modify
11%
Restore
24%
Remove
13%
Reuse
12%
Replace
40%
Restore
Replace
Reuse
Remove
Modify

FIG. 21

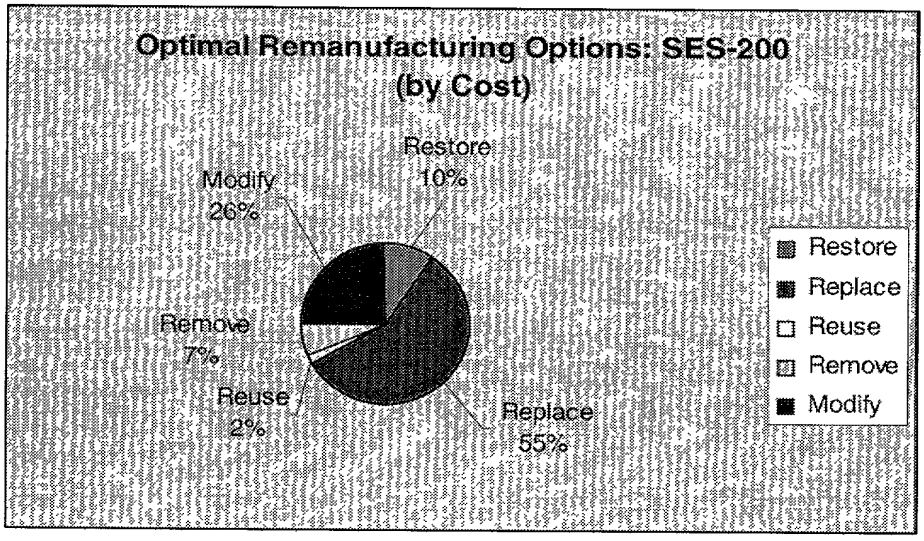

Optimal Remanufacturing Options: SES-200
(by Cost)
Restore
10%
Modify
26%
Remove
7%
Reuse
2%
Replace
55%
Restore
Replace
Reuse
Remove
Modify

FIG. 22

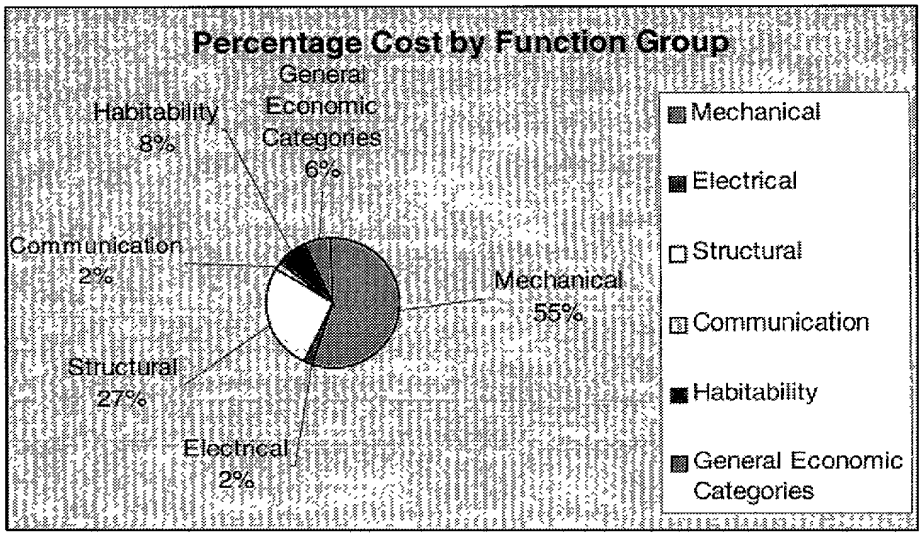

Percentage Cost by Function Group
General Economic Categories 6%
Habitability 8%
Communication 2%
Mechanical 55%
Structural 27%
Electrical 2%
Mechanical
Electrical
Structural
Communication
Habitability
General Economic Categories

FIG. 23